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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/580,436	05/24/2006	Shinsuke Okada	128096	2567

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OLIFF & BERRIDGE, PLC
P.O. BOX 320850
ALEXANDRIA, VA 22320-4850

EXAMINER	
ARENA, ANDREW OWENS	
ART UNIT	PAPER NUMBER
2811	

NOTIFICATION DATE	DELIVERY MODE
07/09/2010	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

OfficeAction25944@oliff.com
jarmstrong@oliff.com

Office Action Summary	Application No.	Applicant(s)	
	10/580,436	OKADA ET AL.	
	Examiner	Art Unit	
	Andrew O. Arena	2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 April 2010*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-80* is/are pending in the application.

4a) Of the above claim(s) *4-10 14-16, 29, 33-40, 42 and 43* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3,11-13,17-28,30-32,41 and 44-80* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *5/24/06, 9/5/06, 8/19/09*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Applicant's election without traverse of Species I –substantially as in Fig 1a - in the reply filed on 04/19/2010 is acknowledged.

The restriction dated 3/19/2010 identified Species III - characterized by modified layer, which is described in the instant spec as altering adhesion (pg 50 ¶2) - as mutually exclusive of elected Species I. Claim 14 recites adhesion and is considered drawn to Species III; the reply of 4/19/2010 elects claim 14, which is assumed an error.

Accordingly, claims 4-10, 14-16, 29, 33-40, 42 and 43 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as drawn to nonelected species, there being no allowable generic or linking claim.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 2, 11-13, 27, 28, 30, 32, 41 and 44 and are rejected under 35 U.S.C. 102(b) as being anticipated by Haruyama (Cite No. 3 on Aug 19 2009 IDS).

RE claim 1, Haruyama discloses a rectifying device, comprising (Fig 1a):

a pair of electrodes (Au contact / Al substrate); and

a carrier transporter (MW CNT) arranged between the pair of electrodes and composed of one or multiple carbon nanotubes,

characterized in that a first connection configuration between one electrode of the pair of electrodes and the carrier transporter and a second connection configuration between the other electrode of the pair of electrodes and the carrier transporter are made different from each other in such a manner that a first interface between the one electrode and the carrier transporter and a second interface between the other electrode and the carrier transporter have different barrier levels (one tunnel barrier).

RE claim 2, Haruyama discloses the carrier transporter is composed of multiple carbon nanotubes (Fig 1a).

RE claim 11, Haruyama discloses a material for the one electrode (Al) and a material for the other electrode (Au) are made different “in such a manner that” the first interface and the second interface have different barrier levels (quoted recitation does not structurally distinguish per MPEP § 2114, claim language considered met since Haruyama discloses different materials and different barrier levels).

RE claim 12, Haruyama discloses the materials composing the one electrode (Al) and the other electrode (Au) each independently comprise at least one metal selected from the group consisting of aluminum, silver, copper, silicon that is made conductive, gold, platinum, titanium, zinc, nickel, tin, magnesium, indium, chromium, manganese, iron, lead, palladium, tantalum, tungsten, molybdenum, vanadium, cobalt, hafnium, and lanthanum, or an alloy thereof.

RE claim 13, Haruyama discloses the material composing the other electrode (Au) comprises at least one metal selected from the group consisting of gold, titanium, iron, nickel, tungsten, silicon that is made conductive, chromium, niobium, cobalt, molybdenum, and vanadium, or an alloy thereof.

RE claim 27, Haruyama discloses carrier transporter is laminar, and the carbon nanotube structure is pattered into a predetermined shape.

RE claim 28, Haruyama discloses the barrier level at the first interface is higher than the barrier level at the second interface; and

a width of a surface of the one electrode is equal to or greater than a width of the carrier transporter at an interface between the one electrode and the carrier transporter.

RE claim 30, Haruyama discloses comprising a sealing member (e.g., alumina) for sealing at least the first interface against external air.

RE claim 32, Haruyama discloses a method of manufacturing a rectifying device including (e.g, Fig 1a):

a base body (e.g., alumina);

a pair of electrodes (Au contact / Al substrate) arranged on a surface of the base body; and

a carrier transporter (MW CNT) arranged between the pair of electrodes and composed of one or multiple carbon nanotubes,

characterized by comprising a connection configuration forming step of forming a first connection configuration between one electrode of the pair of electrodes and the carrier transporter and a second connection configuration between the other electrode

of the pair of electrodes and the carrier transporter into different configurations in such a manner that a first interface between the one electrode and the carrier transporter and a second interface between the other electrode and the carrier transporter have different barrier levels (single tunnel barrier).

RE claim 41, Haruyama discloses the connection configuration forming step includes a step of forming the pair of electrodes from different materials.

RE claim 44, Haruyama discloses the carrier transporter is formed by a network structure in which multiple carbon nanotubes which are not chemically bonded together are entangled (e.g., nested as in the MWCNT).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 3, 17-26, 31 and 45-80 are rejected under 35 U.S.C. 103(a) as obvious over Haruyama as applied to claim 1 above, in further view of Tour (US 2007/0297216).

RE claim 3, Haruyama arguably differs from the claimed invention only in not explicitly stating the multiple carbon nanotubes mutually cross-link

Tour is analogously directed to nanotube based electronic circuitry (e.g., ¶3, ¶105 ln 10), discloses the nanotubes mutually cross-link (e.g., Fig 2) to provide the

active transport layer in a device (e.g., Fig 21-22) with attendant advantages such as quick, accurate and affordable manufacture of small, fast devices (e.g., ¶5, 12, 129).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made that the carrier transporter is formed by a carbon nanotube structure having a network structure in which the multiple carbon nanotubes mutually cross-link; at least for quick, accurate and affordable manufacture of small, fast devices.

RE claim 17, Haruyama in view of Tour discloses the carbon nanotube structure is obtained by chemically bonding functional groups bonded to multiple carbon nanotubes to form cross-linked sites (Tour, e.g., ¶41 & 105).

RE claim 18, Haruyama in view of Tour discloses the multiple carbon nanotubes mainly comprise single-wall carbon nanotubes.

RE claim 19, Haruyama in view of Tour discloses the multiple carbon nanotubes mainly comprise multi-wall carbon nanotubes.

RE claims 20 & 21, Haruyama in view of Tour discloses the claimed compounds are included (Tour, e.g, ¶s 40 & 131).

RE claim 22, Haruyama in view of Tour discloses a solution containing multiple carbon nanotubes to which functional groups are bonded to form the cross-linked sites by chemically bonding the functional groups of the multiple carbon nanotubes.

RE claim 23, Haruyama in view of Tour discloses solution containing multiple carbon nanotubes to which functional groups are bonded and a cross-linking agent capable of prompting a cross-linking reaction with the functional groups is cured to

subject the functional groups and the cross-linking agent to a cross-linking reaction, to thereby form the cross-linked sites (also, this is an apparatus claim, see MPEP § 2113).

RE claim 24, Haruyama in view of Tour discloses the cross-linking agent comprises a non-self-polymerizable cross-linking agent.

RE claim 25, Haruyama in view of Tour discloses the cross-linked sites have structures formed by chemical bonding of the functional groups.

RE claim 26, Haruyama in view of Tour discloses the structure implied by the process having (MPEP § 2113) a reaction that forms the chemical bonding comprises a reaction selected from the group consisting of dehydration condensation, a substitution reaction, an addition reaction, and an oxidative reaction.

RE claim 31, Haruyama arguably differs from the claimed invention only in not explicitly stating a flexible base body.

Tour is analogously directed to nanotube based electronic circuitry (e.g., ¶3, ¶105 ln 10) on the surface of a base body (208) which is not limited (¶102) and would be understood as encompassing flexible base body.

It would have been obvious to a person having ordinary skill in the art at the time the invention was made that a flexible base body having the rectifying device formed on its surface be made; at least for non-rigid applications.

RE claim 45, Haruyama arguably differs from the claimed invention only in not explicitly stating the multiple carbon nanotubes mutually cross-link

Tour is analogously directed to nanotube based electronic circuitry (e.g., ¶3, ¶105 ln 10), discloses the nanotubes mutually cross-link (e.g., Fig 2) to provide the

active transport layer in a device (e.g., Fig 21-22) with attendant advantages such as quick, accurate and affordable manufacture of small, fast devices (e.g., ¶5, 12, 129).

It would have been obvious to a person having ordinary skill in the art at the time the invention was made that the carrier transporter is formed by a carbon nanotube structure having a network structure in which the multiple carbon nanotubes mutually cross-link; at least for quick, accurate and affordable manufacture of small, fast devices.

RE claim 46, Haruyama in view of Tour encompasses prior to the connection formation forming step, a carrier transporter forming step of forming the carrier transporter, characterized in that the carrier transporter forming step includes:

a supplying step of supplying the surface of the base body with multiple carbon nanotubes having functional groups; and

a cross-linking step of cross-linking the functional groups via cross-linked sites to form the carbon nanotube structure having the network structure (Tour).

RE claim 47, Haruyama in view of Tour discloses the supplying step includes an applying step of applying a solution containing the carbon nanotubes having the functional groups to the surface of the base body; and the carbon nanotube structure is filmy (per MPEP § 2112).

RE claim 48, Haruyama in view of Tour discloses the multiple carbon nanotubes mainly comprise single-wall carbon nanotubes.

RE claim 49, Haruyama in view of Tour discloses the multiple carbon nanotubes mainly comprise multi-wall carbon nanotubes.

RE claim 50, Haruyama in view of Tour discloses supplying a cross-linking agent for cross- linking the functional groups to the surface of the base body.

RE claim 51, Haruyama in view of Tour discloses the cross-linking agent comprises a non-self-polymeriziable cross-linking agent.

RE claim 52, Haruyama in view of Tour discloses the functional groups comprise at least one functional group selected from the group consisting of-OH, -COOH, -COOR (where R represents a substituted or unsubstituted hydrocarbon group), -COX (where X represents a halogen atom), -NH2, and -NCO; and

the cross-linking agent is capable of prompting a cross-linking reaction with the selected functional group.

RE claim 53, Haruyama in view of Tour discloses the cross-linking agent comprises at least one cross-linking agent selected from the group consisting of a polyol, a polyamine, a polycarboxylic acid, a polycarboxylate, a polycarboxylic acid halide, a polycarbodiimide, and a polyisocyanate; and

each of the functional groups is capable of prompting a cross-linking reaction with the selected cross-linking agent.

RE claim 54, Haruyama in view of Tour discloses the functional groups comprise at least one functional group selected from the group consisting of-0H, -COOH, -C00R (where R represents a substituted or unsubstituted hydrocarbon group), -COX (where X represents a halogen atom), -NH2, and -NCO;

the cross-linking agent comprises at least one cross-linking agent selected from the group consisting of a polyol, a polyamine, a polycarboxylic acid, a polycarboxylate, a polycarboxylic acid halide, a polycarbodiimide, and a polyisocyanate; and

a combination of the selected functional group and the selected cross-linking agent is capable of prompting a mutual cross-linking reaction.

RE claim 55, Haruyama in view of Tour discloses each of the functional groups comprises -COOR (R represents a substituted or unsubstituted hydrocarbon group).

RE claim 56, Haruyama in view of Tour discloses the cross-linking agent comprises a polyol.

RE claim 57, Haruyama in view of Tour discloses the cross-linking agent comprises at least one selected from the group consisting of glycerin, ethylene glycol, butenediol, hexynediol, hydroquinone, and naphthalenediol.

RE claim 58, Haruyama in view of Tour discloses a reaction for cross-linking the functional groups in the cross-linking step comprises a reaction for chemically bonding the functional groups.

RE claim 59, Haruyama in view of Tour discloses the supplying step includes supplying an additive that forms the chemical bonding of the functional groups to the surface of the base body.

RE claim 60, Haruyama in view of Tour discloses the reaction comprises dehydration condensation and the additive comprises a condensation agent.

RE claim 61, Haruyama in view of Tour discloses the functional groups comprise at least one functional group selected from the group consisting of-COOR (where R

represents a substituted or unsubstituted hydrocarbon group), -COOH, -COX (where X represents a halogen atom), -OH, -CHO, and - NH2.

RE claim 62, Haruyama in view of Tour discloses each of the functional groups comprises –COOH.

RE claim 63, Haruyama in view of Tour discloses the condensation agent comprises one selected from the group consisting of sulfuric acid, N-ethyl-N'-(3-dimethylaminopropyl)carbodiimide, and dicyclohexyl carbodiimide.

RE claim 64, Haruyama in view of Tour discloses the reaction comprises a substitution reaction and the additive comprises a base.

RE claim 65, Haruyama in view of Tour discloses the functional groups comprise at least one functional group selected from the group consisting of-NHz, -X (where X represents a halogen atom), -SH, -OH, -OSO2CH3, and - OSO2(C6Ha)CH3.

RE claim 66, Haruyama in view of Tour discloses characterized in that the base comprises one selected from the group consisting of sodium hydroxide, potassium hydroxide, pyfidine, and sodium ethoxide.

RE claim 67, Haruyama in view of Tour discloses characterized in that the reaction comprises an addition reaction.

RE claim 68, Haruyama in view of Tour discloses the functional groups comprise at least one chosen from -OH and -NCO.

RE claim 69, Haruyama in view of Tour discloses the reaction comprises an oxidative reaction.

RE claim 70, Haruyama in view of Tour discloses each of the functional groups comprises -SH.

RE claim 71, Haruyama in view of Tour discloses the additive comprises an oxidative reaction accelerator.

RE claim 72, Haruyama in view of Tour discloses the oxidative reaction accelerator comprises iodine.

RE claim 73, Haruyama in view of Tour discloses the carrier transporter is formed by a carbon nanotube structure having a network structure in which the multiple carbon nanotubes mutually cross-link; and the method further comprises a patterning step of patterning the carbon nanotube structure into a pattern corresponding to the carrier transporter.

RE claim 74, Haruyama in view of Tour discloses the patterning step comprises a step in which the carbon nanotube structure in a region on the surface of the base body other than a pattern corresponding to the carrier transporter is subjected to dry etching to remove the carbon nanotube structure in the region, whereby the carbon nanotube structure is patterned into a pattern corresponding to the carrier transporter.

RE claim 75, Haruyama in view of Tour discloses a resist layer forming step of forming a resist layer above the carbon nanotube structure in a region on the surface of the base body having the pattern corresponding to the carrier transporter; and

a removing step of removing the carbon nanotube structure exposed in a region other than the region by subjecting a surface of the base body on which the carbon nanotube structure and the resist layer are laminated to dry etching.

RE claim 76, Haruyama in view of Tour discloses in the removing step, the surface of the base body on which the carbon nanotube structure and the resist layer are laminated is irradiated with an oxygen molecule radical.

RE claim 77, Haruyama in view of Tour discloses oxygen molecules are irradiated with ultraviolet rays to generate an

RE claim 78, Haruyama in view of Tour discloses the patterning step further includes a resist layer peeling-off step of peeling off the resist layer formed in the resist layer forming step subsequent to the removing step.

RE claim 79, Haruyama in view of Tour discloses the resist layer comprises a resin layer.

RE claim 80, Haruyama in view of Tour discloses the patterning step comprises a step of patterning the carbon nanotube structure into the pattern corresponding to the carrier transporter by selectively irradiating the carbon nanotube structure in a region of the surface of the base body other than the region having the pattern corresponding to the carrier transporter with an ion beam of a gas molecule to remove the carbon nanotube structure in the region.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Andrew O. Arena whose telephone number is (571)272-5976. The examiner can normally be reached on M-F 8:30-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lynne A. Gurley can be reached on 571- 272-1670. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Andrew O. Arena/
Examiner, Art Unit 2811
2 July 2010

/Lynne A. Gurley/
Supervisory Patent Examiner, Art Unit 2811